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METEOROLOGICAL BIBLIOGRAPHY.*

FOR the first time in history, the Congress of the United States has been stingy. Hitherto that great country has been conspicuous for greater excellence in its official publications, and for greater liberality in distributing them, than any country in the world. But for some reason, of which we on this side of the Atlantic know nothing, General Greely has been refused authority to print the Bibliography which meteorologists throughout the world are waiting for.

Probably in this case (as in other countries), those who have been elected to Congress do not understand the details of scientific work, and think that they are stopping a waste of money by refusing to order the printing to be undertaken. We know that the contrary is the truth; and that nothing will tend more towards assuring that every dollar expended upon meteorology will obtain a dollar's worth of progress, than the publication of this work. Perhaps it may be well to give a homely illustration from the last few numbers of this magazine. In the March number appeared a letter upon the subject of Anchor Ice. We turned up such notices of it as we remembered, or could find, but there were but four, and a fifth was given in the April number. But on turning to the work now before us, we find four quarto pages of titles of papers upon the subject—the total number being not five, but sixty-two. Let some one read up these sixty-two memoirs, work them into a single monograph, and the whole subject will probably be completely elucidated and disposed of, so that further time need never be spent upon it.

We cannot believe that Congress will, when the subject is clearly

* BIBLIOGRAPHY OF METEOROLOGY.—A classed catalogue of the printed literature of meteorology from the origin of printing to the close of 1881; with a Supplement to the close of 1887, and an Author Index. Prepared under the direction of General Greely, edited by Oliver L. Fassig, Bibliographer and Librarian, Signal Office. Part I., Temperature. Washington Signal Office, 1889, 4to, 381 pages.

placed before it, refuse to do that which (1) it, by its officer,* undertook to do, and (2) which would confer a benefit not only upon their own Signal service, but on every meteorological organization in the world.

Still, we all know that good comes out of evil; and this obstruction has compelled General Greely, for the needs of his own office, to get the material into shape; and he seems to have produced the invaluable work before us by a type writer with lithographic ink, and he has been good enough to pull a few extra copies and send them to some of those who, about seven years ago, did what they could to help the Signal office when under the direction of his predecessor.

This volume deals with only one subject, Temperature, yet it contains about 5,000 entries of separate books and papers, or about one-tenth of the whole bibliography. The sub-division was originally arranged by Dr. Lancaster, of Brussels, and subsequently modified by Mr. Sawyer, the former librarian of the Signal Office. It is so good, and will give so thorough an indication of the character of the work, that we print it, and against each heading the number of pages occupied by the titles in each section.

Temperature in general	12	Vertical distribution of temperature	18
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As specimens of the entries, we give the first, and the last of the first section.

Redi F. Della natura del caldo e del freddo lettera. 2 ed. 4to, Firenze, 1590.

Influence des forêts sur la temperature de l'air et du sol. *Ciel et terre*, Brux. III., 1887-88, 149, 151.

We said that good had come out of evil; and it is in this way:—Those of us who can spare time can treat these copies as proofs, and mark down every imperfection and addition, and then when Congress eventually realizes the position and authorizes the final printing, if

* Extract from letter dated November 4th, 1881, addressed by General Hazen, Chief Signal Officer to Mr. G. J. Symons:—"The great advantage to all interested in meteorology that would result from having a complete bibliography of the literature of this subject is acknowledged on all sides, and I shall be pleased to accept your offer, and will print, with full recognition, the card catalogue of 20,000 titles already compiled by you, in connection with that compiled by Professor Abbe."

these copies be returned to Washington, and all the notes be incorporated, the final work will be far better than it would have been without; and though many of us sadly grudge the years we have had to wait, future generations will profit by our loss.

MR. WHIPPLE ON LIGHTNING PHOTOGRAPHS.

AT a recent meeting of the Physical Society, Mr. Whipple read a paper in which he dealt with two of the many interesting questions, raised by the rapidly spreading practice of photographing lightning. The paper and the discussion were reported in *Industries* as follows:

THE DARK FLASH SEEN IN SOME LIGHTNING PHOTOGRAPHS.

The author referred to the fact that some two years ago the Meteorological Society issued a circular asking for photographs of lightning flashes, and in reply to this circular a large number were received from different parts of the world, but chiefly from France and Belgium. Prints from these photographs have been pretty widely distributed, and have attracted a great deal of attention. Our readers may remember that much interest was excited by the ribbon-like character of the markings observed in the photographs of some of the flashes, and still more by the so-called "dark flash," viz., a dark mark on the surface of the photograph, having all the characteristics of a lightning flash except in its being dark instead of light. Professor Stokes had suggested that the dark flash might be caused by one flash following exactly the same path as another immediately preceding it, and having some of its light cut off, more especially the highly refrangible rays, which would mainly affect the photographic plate, by having to traverse the nitrous oxide gas, formed by the decomposition of ammonia during the passage of the first flash. With respect to the ribbon markings, it occurred to the author that they might be due to the photographs having been taken through the glass of a window. He had not yet had the opportunity of testing this, by actually taking photographs of lightning flashes through interposed sheets of glass; but he had endeavoured to get an effect somewhat similar to that of a flash, by drawing a wavy chalk line on a black board, and photographing it after having previously interposed a sheet of plate or window glass slightly deviating from the plane perpendicular to the axis of the lens. These photographs, which were exhibited to the Society, showed a remarkable likeness to the ribbon markings observed in the photographs of the lightning flashes, and it seems probable that this may be the true explanation of them. It occurred to the author that the dark flash observed on some of the prints might have been due to a somewhat similar cause, viz., to internal reflection within the glass of the negative plate, and he pointed out how such an effect might be produced if the printing was effected by means of sunlight fall-

ing somewhat obliquely upon the negative. He had tried to test this by means of photographs of the chalk lines drawn upon the black board; but he had been unable to make many experiments, owing to the recent weather having been unsuitable for printing. He showed, however, a photograph which exhibited, though not very perfectly, an effect of the kind.

In the course of the discussion which followed, Dr. Gladstone said that though he naturally hesitated to criticise anything that Professor Stokes had suggested as an explanation of an optical phenomenon, yet he found it very difficult to imagine that one flash should follow so exactly the same path as one which had just preceded it, and it also appeared difficult to believe that a sufficient quantity of nitrous oxide could be produced to show the observed effect. Some of the photographs which showed the dark flash very clearly had been taken by a Mr. Shepherd at Westbourne-grove, so that the negatives would probably be available, and an examination of them would decide between the two explanations; for if Mr. Whipple's explanation was the true one, the dark flash would not be shown upon the negative.

Mr. Boys stated that he always made a point of observing a lightning flash whenever possible, and that he had often observed a series of flashes following immediately one after the other in exactly the same path, every turn and twist in one flash being observed in those which followed it, and the whole series occurring in a fraction of a second.

Since writing the above we hear that a writer in the *Bayswater Chronicle* says, speaking from personal knowledge, that the "ribbon" lightning photograph was taken in the open air, and not through a window, and that the dark flash is not a reversion of any other flash shown in the same plate. The only theory which so far explains the curious phenomenon, of a dark flash of lightning being seen amongst the ordinary white flashes in a photograph, seems to be that which has been offered by Prof. Stokes, F.R.S., and Prof. Curtis, of Harvard University. Both these authorities arrived independently at the conclusion that the dark flash shown is really the path of a dead flash—that is, a vanished flash which has left a track of heavy nitrous oxide gas behind it in the atmosphere, impervious to the light of the flashes immediately following, and thus appearing opaque in the picture. We understand that Prof. Stokes's suggestion for charging a camera in the daytime during a thunderstorm, and taking off the cap just after a flash has disappeared, will be adopted, inasmuch as according to the theory, a dead flash should certainly then record itself on the plate.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on the 17th ult., at the Institution of Civil Engineers, 25, Great George-street, Westminster, Dr. W. Marcet, F.R.S., President, in the chair.

Mr. R. C. Mossman and Mr. E. H. Ryan-Tenison, M.R.C.S., were elected Fellows of the Society.

The following papers were read :—

1. "On the Deaths caused by Lightning in England and Wales from 1852 to 1880, as recorded in the returns of the Registrar-General," by Inspector-General R. Lawson, LL.D. The total number of deaths from lightning during the 29 years amounted to 546, of which 442 were of males, and 104 of females. In consequence of their greater exposure, the inhabitants of rural districts suffer more from lightning than those of towns. It appears also that proximity to the west and south coasts reduces the chances of injury by lightning, and that elevation and distance from the coast seem to increase them.

2. "The Diurnal Range of the Barometer in Great Britain and Ireland," by Mr. F. C. Bayard, F.R. Met.Soc. The author has reduced the hourly records of the barometer at the nine observatories, Aberdeen, Armagh, Bidston, Falmouth, Glasgow, Greenwich, Kew, Stonyhurst. and Valencia, during the years 1876-1880. The curves for inland places are smoother than those for places on the sea coast, and the curves for places to the westward and southward are more irregular than those for places to the eastward and northward.

3. "Note on a Working Model of the Gulf Stream," by Mr. A. W. Clayden, M.A., F.R.Met.Soc. The author showed this interesting model (which has been constructed to illustrate the formation of ocean currents in general, and of the Gulf Stream in particular) and explained how the currents were produced.

4. "On the Rime-frost of January 6th and 7th, 1889," by Mr. C. B. Plowright, F.L.S. The author sent an account of the very heavy rime which occurred in the neighbourhood of King's Lynn on the above days, when the fringe of crystals upon twigs and branches of trees was about two inches in length. The weight was so great that nearly all the telegraph wires were snapped, and many branches of trees were broken off.

LONDON FOG AND ITS EFFECTS ON PLANTS.

The Royal Horticultural Society has lately been giving much attention to the above subject, and has resolved upon collecting and publishing such information as may be forthcoming. This course has been resolved upon in accordance with a suggestion, made at the Scientific Committee's meeting by Mr. Thiselton Dyer, F.R.S., the Director of the Royal Gardens at Kew, who said that they had not much ground for complaint at Kew until the winter of 1887-1888.

The fog proved injurious in two ways. First, in forming an oily deposit of dirt which was left on all the glass houses. This was so thick, and of so intractable a character that every pane had to be washed by hand. The houses looked as if they had slate roofs instead of being glazed. The same result occurred in the winter of 1888-1889. Secondly, with regard to the injury to plants, it seemed out of all proportion to the nature of the fog, especially so on Orchids. Thus, *e.g.*, when a fog comes on, the inflorescence of species of Phalænopsis breaks up, and the flowers disarticulating fall off. Many plants suffer more or less, and especially such as have a more tender foliage. Mr. Dyer remarked that the young foliage of a Carpenteria growing on a south wall did not suffer, while another plant under glass, with possibly tenderer foliage, was severely injured. The fogs extended even as far as Dorking, for Sir Trevor Lawrence lost a large number of flowers in a few hours. Mr. Veitch remarked that he found injurious effects to follow the two kinds of fogs, those caused by London smoke, and the ordinary country white fogs. In the dull weather accompanying the latter, flowers would not expand properly, as was particularly the case with early varieties of Lælia anceps. The yellow fogs of London had been getting steadily worse for the last twenty years. Camellias frequently lost their buds, especially certain kinds, as double whites. A peculiar feature observed by Mr. Veitch was, that the fog seemed to gum up the buds at a certain stage of development, though either before or after that particular period of growth the buds were unaffected by the fog. He mentioned that 1000 flowers of Cattleyas were lost in three weeks.

THE PROPOSED BERMUDA-HALIFAX CABLE: ITS USEFULNESS FOR WEATHER PREDICTIONS.

The announcement made by the British Postmaster-General (says the *New York Herald*), that the Government intended to lay a submarine cable between Bermuda and Halifax, will be good news to all Atlantic seamen and all American and European meteorologists. Bermuda is a natural observatory for watching hurricanes emerging from the tropical ocean and threatening to assail the United States, or to advance north-eastwardly from the Gulf Stream into the transatlantic steamer tracks, and subsequently to burst upon the shores of Europe. Of course an observer at Bermuda cannot see with the naked eye what a Gulf Stream storm is doing, or determine by ocular demonstration what its course will be. But by watching the fluctuations of the barometer at this mid-Atlantic station, and by reporting them by cable to America and Europe, meteorologists on either continent will be enabled to feel the pulse of the storm and to determine more accurately its intensity and its future movements. For purposes of weather and storm forecasting in our Atlantic States, therefore, weather cablegrams from Bermuda will be invaluable.

REVIEWS.

Egeson's Weather System of Sunspot Causality, being original researches in solar and terrestrial meteorology. By CHARLES EGESON, Weather Map Compiler, Sydney Observatory, New South Wales. Turner and Henderson, Sydney, 1889. 8vo., ix., 63 pages. 5 folding plates.

IT is of course very rash for a reviewer to presume to question a dictum by Herbert Spencer, but we hold that the following lines from Chapter V. of the work before us are untrue, and are libellous of meteorology.

"Herbert Spencer has told us that the object of all science is to enable us to predict phenomena. Meteorology has no other object."

We do not produce arguments against these statements, because we believe that they will occur to every reader. But we have quoted these lines, because, although we cannot go the length which Mr. Egeson does, and say that meteorology has no other object than prediction, we desire to assure him that our strongest sympathies are with him, and with all who honestly try to detect the basis on which long period predictions can be established. We know that some leading British meteorologists have declared it to be impossible to predict more than a day or two in advance. If that were certain, and if Mr. Herbert Spencer's dictum were true, we suppose that every meteorological observatory ought to be dismantled. But it is not our view, we cling to the hope that, complex as is the problem, it will eventually be solved, therefore it is, that we have no sympathy with those who scoff at honest attempts to pierce the mystery, and that is why nothing would give us greater pleasure than to express our conviction that Mr. Egeson had proved his case, and that a triple sunspot, or 33 year, period was the solution of the whole question. There is one charm about Mr. Egeson's book, he has done what Fullbrook did in his *Wet and Dry Seasons in England,* carried his curves four years into the future, so that all can compare the forecasts with the facts.

Now that we are being told that Nebulæ, if not also stars, are merely colliding meteors, we must not speak disrespectfully of them, but really we scarcely know how to believe that sunspots (large enough for a dozen worlds as large as the one we inhabit to be dropped through simultaneously and side by side), are produced by the impact of meteors. How many hundred millions would be required? Although the author quotes this theory, he seems to feel that it is hardly safe to trust to it, and so he wisely comes back to the sunspots themselves and leaves their production alone.

In such work as the author has here undertaken, the great danger is that of deceiving one's self. Every step in the process of investigation should be fixed rigorously; if not, one is sure to fall into the temptation of tossing in the direction one wishes, and a multitude of little tossings produces a sensible effect. We notice

two weaknesses of this kind on page 14, in the first and second line Mr. Egeson writes, "where seven days intervene, give three to one and four to the other indiscriminately." For "indiscriminately," he should have said "alternately." The other case is more complicated, the author has worked out, for what we may perhaps be permitted to describe as lunar weeks, their relative wetness and he gets the following values :—

1, 2, 5, 4, 3, 7, 3, 5, 2, 2, 0, 4, 2, 1, 1, 2, 1, 3, 0, then he says, "When projected, these give a better idea of mutual relation than "their appearance here; but this must appear to every one, that "the increase from 1 to 2 and 5 forms a rising slope, and the falling "slope is represented by the figures 5, 4, 3. This I call a period. "The number 5 represents the maximum, and 1 and 3 are two "mimima. Thus the max. in the series are (5) 7, 5, 4, 2 and 3." The author has forgotten to insert in this little list the first max. of 5, so we put it in ( ). But we have a serious question to ask. Why do we find in the list of max. such very low values as 2 and 3? Within two lines we are told that "1 and 3 are the two minima," and that "the max. in the series are . . . . 2 and 3."

A very similar series of anomalies occurs on page 44, where the author applies some curious method and picks out min. which are not min., and max. which are not max., because rather high or rather low values occur in the years in which his theory requires them. Considering that his book reached England early in April we may surely assume that it was printed not later than February 1889. Here then is a droll sentence.

"The extreme maxima of 1857 and 1888-90, representative of our local thirty-three year cycle, is (sic.) marked with double asterisks" —a double? would surely be more appropriate. April 1889 had not commenced when the book was printed, far less had April 1890. April 1888 had a high mean pressure, the highest since April 1857, but that was 31 years not 33, and that is the only explanation which occurs to us for the remarkable bracketing of prophetic values for 1889 and 1890, along with the real one in 1888, which seems to have come two years too soon.

By a mysterious process of which we cannot approve, Mr. Egeson evolves the depth of rain at Sydney, when there was no gauge, from the number of entries of rainy days, and jumps at values for Sydney by adding 10 (which he afterwards says should be 12) inches to each year at Parramatta (or Paramatta he spells it both ways). We say jumps because evidently the quantity to be added varies with the total; suppose the mean at Parramatta to be 36 in., and at Sydney 48, then when the Parramatta fall was 24, only 8 should be added, and when at Parramatta it was 48, the addition should be 16. And yet after this loose way of making up returns, Mr. Egeson has the assurance to write.

"This then ($45\frac{1}{2}$ in.) is Sydney's mean annual rainfall, and not

49½ in. as published in official returns, and deduced from the records since 1840."

The author has worked at his subject as only those work whose hearts are in it—but he is not methodical, and, therefore, has not afforded the demonstrations which perhaps he could. For instance the diagrams facing page 20 are most aggravating. We have four diagrams, one pair showing sunspot area for two years, and the other pair, rainfall for two years—but when one begins to compare them, one finds that the first pair are for 1882 and 1887, the other pair for 1887 and 1888.

Untersuchungen ueber die tägliche Oscillation des Barometers. VON J. HANN, W.M.K. Akad. [Excerpt "Denks. der Math. Naturwissen. classe der K. Akad."] Tempsky, Vienna, 1889, 4to., 73 pages.

THE interest taken in the small daily oscillations of the barometer is rather remarkable. It almost seems as if every meteorologist who reached the front rank felt it obligatory upon him to write a memoir upon the daily range of the barometer; indeed, Dr. Hann in this very paper remarks that the literature upon the subject is already sufficient to fill a small library. A short paper upon it, by Mr. Bayard, is mentioned on p. 53 of this number; another and elaborate investigation, by Dr. Buchan, is, we believe, in a forward state; in France, M. Angot has one either in MS. or in the printer's hands, but as the above title shows Dr. Hann is the first of the present gronp to have his paper completed and published.

It is evident that he who publishes first has an advantage and a disadvantage over his successors—an advantage in that he has priority for any discoveries that he may have made, a disadvantage in that those who come after can profit by his labours, and learn by his mistakes, if he makes any.

Until the American Government print their promised Meteorological catalogue, the labour of every worker in the subject is seriously impeded and injured. Dr. Hann has given the constants for about 120 stations, but we do not think that he has exhausted existing materials, and, much as we admire them, we should not have accepted the indications of Richard's and Höttinger's Barographs for such delicate work. Another matter in which we should have acted differently from Dr. Hann, is in accepting observations made during extremely short periods; out of the 100 in his principal table, there are 28 based upon one year or less, 10 of them being for less than four months. This to us seems hazardous, but Dr. Hann is not one to do things without good warrant, and therefore we do not venture to say that it is unwise. He has doubtless applied the very simple test of trying whether the two halves of these short records, when compared, give nearly identical values.

In considering the influence of altitude above sea level on the

amplitude of the barometric oscillations, Dr. Hann takes up also that of height above ground, and suggests that the Eiffel tower might be utilized for that purpose.

The whole work has been done with that thoroughness and care which characterize the author; he has contributed one more treatise to the existing small library, but one which no student of the subject can afford to ignore.

A List of the More Remarkable Earthquakes in Great Britain and Ireland during the Christian Era, compiled by WILLIAM ROPER, F.S.S., F.R.Met.Soc. Lancaster: T. Bell, 8vo, 46 pages.

IT was our painful duty last year to include the name of our worthy Lancaster observer in the obituary in *British Rainfall*, a section which it is always saddening to prepare, and sometimes especially so when we know that the work of those who are taken from us will be abruptly stopped, no relative taking any interest in it. We had the pleasure during Mr. Roper's lifetime of calling attention to more than one privately printed paper issued by him, and we are glad to recognize in the pamphlet before us the best list of British Earthquakes, and a memorial to a Father's memory better, more useful, and more lasting than marble or granite. For good paper, as we all know, will stand for three or four hundred years without a sign of age—and this pamphlet must be secured for all libraries which pretend to completeness in physical geography, seismology, or geology—and with modern precautions against damp and against fire, we see no reason why the last copy should disappear for many hundred years to come, unless, indeed, the world itself should go also.

Mr. Roper has searched nearly all the old chroniclers, such as Matthew of Paris, Roger de Hoveden, William of Malmesbury, Florence of Worcester, several of the County Histories, O'Reilly's Catalogues in the *Trans. Roy. Irish Acad.*, Mallet's great Catalogue, Meldola's Report on the Essex Earthquake, the *Phil. Trans.*, *Annual Register*, *Gentleman's Magazine*, &c. And though, of course, neither he nor anyone else could sift the wheat of truth from the chaff of fiction, with which a thousand years since it was considered imperative to mingle every statement, still we believe that he has done all that can be done. Mr. W. O. Roper quite rightly points out that it is exceptionally difficult to avoid errors in such a work as this—but it may be well for us to mention something bearing on the other side of the question, viz., that in many works wrong dates are given, owing to the old plan of writing the date double (*e.g.*, 1615/16), when the year instead of beginning with January, began in the spring, and that Mr. Roper spent much time in comparing the older records, and trying to assign the shocks to the proper year—so that his dates must not be lightly impugned.

The list is chronological, starting with the year 10 and coming

down to 1889, but a complete alphabetical index to localities is given at the end, and alongside of every statement is given the short title of the book, and the volume, and page whence it has been quoted.

ROYAL SOCIETY SOIRÉE.

Meteorology was not strongly represented this year, there being only two exhibits.

(1) *A Model illustrating the formation of Ocean Currents* by Mr. A. W. Clayden, M.A., F.G.S.

This consisted of a map of the Atlantic, on Mercator's projection, in which the seas were represented by the surface of some water over which Lycopodium powder had been scattered.

A foot blower was attached, and when it was worked a gentle blast of air was delivered from a number of tubes, in such a way as to set up a circulation of air resembling that of the atmosphere over the real ocean. These imitation prevalent winds acted upon the water, and created a system of currents resembling those of nature.

Special attention was directed to the Gulf Stream, issuing from the Gulf of Mexico, to the return current flowing eastwards between the two great equatorial currents, and to the Labrador current flowing from Baffin's Bay.

Portions of Central America were made removable, and when they were taken out it was noticed how the water of the Gulf Stream fails to reach our shores.

(2) *Air Meter for registering high velocities* exhibited by Mr. W. H. Dines, B.A.

ANCHOR ICE ON THE SEVERN.

This description of ice, locally called stock or frodge ice, is not uncommon on the Severn in frosty weather, between Stourport and Gloucester.

In severe frosts, the lampern wheels and putcheons (wicker-work constructions for catching lamperns and eels) are lifted from the bottom of the river, dragging their anchor stones, bricks, &c., with them, the wheels and putcheons being then double their ordinary size from the ice coated upon them.

Ice also at such times frequently rises from the bottom of the river, especially in the neighbourhood of fords or other shallow places.

It also sometimes accumulates on the weirs—as in January, 1881—to such an extent as, if not removed, to raise the water in the river several feet. It must be cleared away before the floating ice comes down or a block would ensue.

This anchor ice will sometimes freeze on the walling and stones of the weirs completely down to the bottom.

H. J. M.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1888.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		TotalRain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	68·8	27	28·2	8	55·4	38·9	41·1	84	99·3	21·3	1·23	7	5·5
Malta	88·8	5	52·0	22	74·5	62·4	58·6	74	135·8	47·4	4·06	7	3·7
Cape of Good Hope.	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	82·7	31	62·0	17	78·4	65·7	63·0	76	133·3	54·3	1·60	14	6·0
Calcutta	91·4	2	66·9	21	87·1	72·9	70·9	66	153·7	59·1	2·51	4	2·6
Bombay	94·5	19	74·4	4	90·1	77·3	74·0	73	144·4	62·8	·11	1	1·8
Ceylon, Colombo	88·7	10	72·0	20	86·4	74·6	71·8	78	145·5	69·3	15·77	23	7·3
Melbourne	86·0	13	35·1	9	65·1	46·7	43·8	64	145·0	27·7	1·35	8	5·0
Adelaide	91·9	22	41·5	8	73·8	51·7	44·0	50	146·9	30·7	·31	5	3·8
Wellington	67·0	28	39·5	3	60·3	47·3	45·3	73	135·0	34·0	3·37	13	3·6
Auckland	...	..	...	...	...	...	...	...	...	..	...	...	...
Jamaica, Kingston	94·4	21	64·7	26	90·8	71·6	73·4	76	...	...	1·83	...	...
Barbados	...	...	...	...	..	...	...	...	...	...	...	...	...
Toronto	62·2	31	28·3	21	50·0	36·4	37·5	78	...	19·0	2·65	20	7·3
New Brunswick, Fredericton	63·7	7	26·0	1	48·9	33·8	35·6	79	...	...	9·99	20	6·9
Manitoba, Winnipeg	71·2	6, 7	20·3	5	49·0	36·0	34·8	82	...	...	2·71	13	6·8
British Columbia, Victoria	69·0	4	31·0	30	57·6	44·7	...	...	...	...	3·35	14	...

REMARKS, OCTOBER, 1888.

MALTA.—Mean temp. 67°·5; mean hourly velocity of wind 10·7 miles. Sea temp fell from 77°·9 to 69°·0. TSS on 8th, 10th, and 12th. L on 17th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·1 below, of dew point 1°·7 above, and R ·02 in. below average. Mean hourly velocity of wind 9·2 miles, or 2·5 below average; extremes 26·2 miles on 7th and 0·0 on 28th. Prevailing direction, E.S.E.
C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·7, of dew point 2°·5 humidity 6, mean amount of cloud 1·0, and R 1·50 in. below the average. Pressure ·160 in. above the average. Prevailing wind S.W. and S.; strong on 11 days. Heavy dew on the 2nd. T and L on the 14th. R. L. J. ELLERY, F.R.S.

Adelaide.—The driest October on record, the R being 1·5 in. below the average of 31 years. Mean temp. 1° above the average. C. TODD.

Wellington.—Showery, with intervals of fine weather. Prevailing wind N.W., strong or stormy on 13 days. Distant T on 24th. Hail on night of 21st. Earthquakes on 23rd and 26th. Mean temp. average; R 1·46 in below average. R B. GORE.

FREDERICTON.—6·81 in. of R in the first 8 days; water in the river as high as an ordinary spring freshet.

VICTORIA.—Unusually dull and overcast.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1889.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Tota Rain.
		in.			in.
II.	Dorking, Abinger Hall.	2·63	XI.	Castle Malgwyn	2·53
,,	Margate, Birchington...	2·01	,,	Rhayader, Nantgwillt..	6·36
,,	Littlehampton	2·08	,,	Carno, Tybrith	4·69
,,	Hailsham	2·06	,,	Corwen, Rhug	4·93
,,	Ryde, Thornbrough	2·26	,,	Port Madoc	4·35
,,	Alton, Ashdell.....	2·54	,,	I. of Man, Douglas	3·52
III.	Oxford, Magdalen Col...	2·51	XII.	Stoneykirk, Ardwell Ho.	2·14
,,	Banbury, Bloxham	2·84	,,	New Galloway, Glenlee	3·30
,,	Northampton	1·69	,,	Melrose, Abbey Gate...	3·32
,,	Cambridge, Beech Ho...	2·10	XIII.	N. Esk Res. [Penicuick]	3·40
,,	Wisbech, Bank House..	2·17	XIV.	Ballantrae, Glendrishaig	2·71
IV.	Southend	2·02	,,	Glasgow, Queen's Park.	1·29
,,	Harlow, Sheering	1·92	XV.	Islay, Gruinart School..	2·36
,,	Rendlesham Hall	1·69	XVI.	Dollar.....	3·85
,,	Diss	2·03	,,	St. Andrews, Pilmour Cot	3·03
,,	Swaffham	2·15	,,	Balquhidder, Stronvar..	4·90
V.	Salisbury, Alderbury...	2·16	,,	Dunkeld, Inver Braan..	4·41
,,	Warminster	3.09	,,	Dalnaspidal H.R.S. ...	5.31
,,	Bishop's Cannings	3·24	XVII.	Keith H.R.S.	4·07
,,	Ashburton, Holne Vic....	2·61	,,	Forres H.R.S.	2·18
,,	Hatherleigh, Winsford.	1·41	XVIII.	Strome Ferry H.R.S....	2·21
,,	Lynmouth, Glenthorne.	2·16	,,	Fearn, Lower Pitkerrie.	1·72
,,	Probus, Lamellyn	2·87	,,	Loch Shiel, Glenaladale	4·18
,,	Launceston, S. Petherwin	1·93	,,	N. Uist. Loch Maddy ...	1·79
,,	Wincanton, Stowell Rec.	3·92	,,	Invergarry	3·78
,,	Taunton, Lydeard Ho...	2·52	,,	Loch Ness, Drumnadrochit	2·07
,,	Wells, Westbury.....	3·54	XIX.	Lairg H.R.S.	2·71
VI.	Bristol, Clifton	4·77	,,	Forsinard H.R.S.	...
,,	Ross	5·64	,,	Watten H.R.S.	2·69
,,	Wem, Clive Vicarage ...	4·62	XX.	Dunmanway, Coolkelure	4·93
,,	Cheadle, The Heath Ho.	2·69	,,	Fermoy, Gas Works ...	3·00
,,	Worcester, Diglis Lock	3·41	,,	Tipperary, Henry Street	3·31
,,	Coventry, Coundon	3·57	,,	Limerick, Kilcornan ...	2·15
VII.	Ketton Hall [Stamford]	2·88	,,	Miltown Malbay.....	2·73
,,	Grantham, Stainby	3·32	XXI.	Gorey, Courtown House	1·93
,,	Horncastle, Bucknall ...	2·05	,,	Navan, Balrath	2·52
,,	Mansfield, St. John's St.	3·55	,,	Mullingar, Belvedere ...	2·56
VIII.	Neston, Hinderton	2·85	,,	Athlone, Twyford	2·57
,,	Knutsford, Heathside ...	2·57	,,	Longford, Currygrane...	2·72
,,	Lancaster, South Road.	2·31	XXII.	Galway, Queen's Coll...	2·03
,,	Broughton-in-Furness ..	2·97	,,	Clifden, Kylemore	3·24
IX.	Wakefield Prison	3·18	,,	Crossmolina, Enniscoe..	3·03
,,	Ripon, Mickley	3·12	,,	Collooney, Markree Obs.	3·31
,,	Scarborough, West Bank	3·41	,,	Ballinamore, Lawderdale	...
,,	East Layton [Darlington]	3·60	XXIII.	Warrenpoint	3·72
,,	Middleton, Mickleton..	2·85	,,	Seaforde	4·25
X.	Haltwhistle, Unthank..	2·88	,,	Belfast, New Barnsley .	3·57
,,	Shap, Copy Hill	3·17	,,	Bushmills, Dundarave...	3·06
XI.	Llanfrechfa Grange	4·53	,,	Stewartstown	3·32
,,	Llandovery	3·68	,,	Buncrana	3·14

APRIL, 1889.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE Max. Deg	Date	Min. Deg	Date	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·06	+ ·04	·35	23	20	63·9	19	32·4	16	0	5
II.		Maidstone (Hunton Court)...	2·59	+ ·74	·48	25	17	...	...	...	...	...	...
,,		Strathfield Turgiss	2·30	+ ·39	·46	6	21	62·8	18	31·8	1	1	13
III.		Hitchin	2·30	+ ·35	·35	10*a*	19	62·0	18	32·0	15	0	...
,,		Winslow (Addington)	2·61	+ ·30	·37	23	22	65·0	18	30·0	16*e*	2	8
IV.		Bury St. Edmunds (Culford)	...	...	..	...	...	...	...	...	...	...	...
,,		Norwich (Cossey)	1·96	+ ·10	·32	13	19	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	1·82	...	·66	7	14	60·0	18*b*	35·0	6, 16	0	...
,,		Barnstaple.....	1·09	— 1·29	·30	23	11	58·0	19	32·0	10	0	...
,,		Bodmin	1·74	— 1·59	·29	27	15	58·0	18	34·0	8	0	6
VI.		Stroud (Upfield)	4·69	+ 2·24	1·00	8	22	65·0	18	34·0	15	0	...
,,		ChurchStretton(Woolstaston)	5·75	+ 3·43	·67	8	24	63·0	18	30·0	15	3	11
,,		Tenbury (Orleton)	4·67	+ 2·50	·92	8	21	66·2	18	30·0	26	6	9
VII.		Leicester (Barkby)	3·18	+ 1·30	·81	10	20	65·0	28	31·0	15	2	10
,,		Boston	2·34	+ ·45	·44	28	22	68·0	19	30·0	3	3	...
,,		Hesley Hall [Tickhill].....	2·43	...	·40	6	20	63·0	27	31·0	15	1	...
VIII.		Manchester (Ardwick).....	2·08	+ ·05	·34	10	16	64·0	27	34·0	15	0	...
IX.		Wetherby (Ribston Hall) ...	2·02	— ·49	·42	7	13	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·84	+ ·78	·60	23	20	61·0	17	32·0	14	0	...
,,		Hull (People's Park)	2·35	+ ·62	·45	28	21	...	...	...	...	...	...
X.		North Shields	2·19	+ ·19	·41	30	21	63·0	20	30·0	2	3	6
,,		Borrowdale (Seathwaite).....	5·64	+ ·70	·74	22	20	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	3·19	+ ·85	·45	30	21	...	...	...	...	...	...
,,		Haverfordwest	2·67	— ·15	·40	23	18	60·0	19	31·0	10	2	11
,,		Plinlimmon (Cwmsymlog) ...	5·16	...	·78	23	17	...	...	...	...	...	...
,,		Llandudno.....	4·72	+ 2·84	·80	8	20	55·8	28	33·0	15	2	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·69	+ ·40	·53	3	16	60·0	17	30·0	15	4	...
,,		Jedburgh (Sunnyside).....	2·55	+ ·85	·35	28	21	59·0	17*c*	30·0	3	2	...
XIV.		Old Cumnock	1·84	+ ·18	·28	3	18	60·0	28	27·0	14*f*	9	...
XV.		Lochgilphead (Kilmory).....	3·28	+ ·65	·59	19	14	...	...	..	...	..	...
,,		Oban (Craigvarren)	2·54	...	·77	19	16	57·8	28	30·2	14	1	...
,,		Mull (Quinish).....	2·52	...	·43	3	15	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·80	+ 1·59	·80	14	9	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·65	+ 1·53	·65	30	19	65·2	17	30·8	2, 3	2	...
XVII.		Braemar	4·09	+ 2·01	·76	30	23	61·2	17	28·0	3, 26	7	22
,,		Aberdeen (Cranford)	3·49	...	·43	3	25	66·0	18	32·0	2	0	..
XVIII		Lochbroom	2·24	...	·44	23	20	...	...	...	...	...	...
,,		Culloden	1·22	— ·13	...	...	...	59·0	17	32·0	3, 26	0	22
XIX.		Dunrobin	3·11	...	·90	3	15	59·5	18	29·0	3	3	...
,,		S. Ronaldsay (Roeberry).....	2·38	+ ·53	·58	10	23	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock)	3·45	+ ·35	1·06	27	18	60·0	17	30·0	12	4	..
,,		Dromore Castle	3·56	...	·80	29	18	61·0	26	32·0	8	0	...
,,		Waterford (Brook Lodge) ...	1·91	...	·23	21	19	63·0	17	27·0	15	2	...
,,		O'Briensbridge (Ross)	2·86	...	1·17	27	16	60·0	*	34·0	1	0	...
XXI.		Carlow (Browne's Hill)	2·01	— ·56	·30	3	20	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·61	+ ·50	·42	11	21	59·7	20	33·1	15	0	8
XXII.		Ballinasloe	2·35	+ ·09	·76	27	18	57·0	19	28·0	12	4	...
XXIII		Waringstown	4·11	+ 2·22	1·12	8	17	64·0	18	30·0	14	1	13
,,		Londonderry (Creggan Res.).	3·14	...	·91	3	19	...	...	...	...	...	...
,,		Omagh (Edenfel).....	3·09	+ 1·09	·53	3	21	55·0	17*d*	34·0	3, 14	0	...

a And 29. *b* And 20, 21. *c* And 19. *d* And 18, 19, 20. *e* And 26. *f* And 25. * Several days.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON APRIL, 1889.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The month commenced with rainy and unsettled weather, and with a low temp. Crops generally looking well at the close. T on 5th, 23rd and 30th; H on 5th and 23rd.

WINSLOW, ADDINGTON.—Greater amounts of R have been recorded in April, but never such a number of rainy days. The nights were cold throughout, but there was very little frost. Swallows arrived on 16th, and the cuckoo on 22nd, its time of arriving varies very little, no matter what the weather may be. T on 5th, 11, 12th, 23rd and 30th; H on 4th, 11th, 23rd and 28th. Some S on 3rd.

WEYMOUTH, LANGTON HERRING.—A typical April. R ·49 below the average. Mean temp. 0°·6 above the average of 17 years. Heavy TS on 12th, and a slight one on 24th. Well defined solar halo on 27th.

BODMIN.—A cold April, but the temp. very similar to that of the five previous Aprils. Mean temp. 45°·8.

WOOLSTASTON.—A cold, ungenial month, the first fortnight being specially inclement and very dark, with constant fog and R. S fell heavily on 6th, 7th and 10th, and again more lightly on 12th. T on 6th, 8th and 24th. Mean temp. 43°·2.

ORLETON.—The first 14 days were very cold, with R every day, and generally a cloudy sky. The remainder of the month was warmer and drier, but the mean temp. of the whole month was about 3° lower than the average of 28 years, although it was nearly 1° higher than that of April, 1888. The R was the largest in April for 58 years, except 1858. On the 8th R set in and continued more or less till the 11th, when about 2·25 in. had fallen, which produced great and long-continued floods in the rivers Teme and Severn. Distant T on 6th, 8th, 23rd, 24th and 30th, and on the 8th, 24th and 30th there were heavy storms within 20 miles. On the morning of the 11th, the hills were covered with S. Cuckoo heard on 21st; chiff-chaff seen about the 6th; and the small summer birds about the 25th, but the swallow has rarely been seen.

BARKBY.—The total R for the first four months this year is 10·57 in., as against 5·57 in. in 1888, or nearly double. First swallow seen on 6th; cuckoo heard on 11th. Mean temp. 45°·6. Vegetation some 10 days backward. T, with heavy H, on 4 days.

HULL.—The month was generally cold, wet, and overcast.

WALES.

HAVERFORDWEST.—The weather was most variable throughout the month, very showery, changeable, and at times very cold, especially from the 5th to the 16th, though there were very few frosts. Although the total R was small, the general character of the month was rainy throughout. Mean temp. rather above the average. Plenty of grass and crops looking well. Blackthorn in flower on 11th; horse chestnut in leaf on 25th. Cuckoo heard on 25th.

SCOTLAND.

CARGEN.—A cold, gloomy month, temp. 2°·6 below the average. Easterly winds prevailed for 17 days, and the duration of sunshine was 53 hours below the average. Vegetation backward.

JEDBURGH.—The weather was cold and ungenial, with much R; still, vegetation progressed fairly. Swallows not yet arrived.

CRAIGVARREN, OBAN.—The month was decidedly warmer than usual, and the R moderate; growth was abundant, and early flowers made a good appearance.

QUINISH, MULL.—A showery, unsettled, and rather cold month, but on the whole very favourable to spring vegetation; hardly any frost at night.

LOCHBROOM.—Upon the whole a capital working month. Very little snow or storm, or anything to retard farming, while sunshine and showers were prevalent, causing green pastures.

CULLODEN, INVERNESS.—The weather generally was cold and the spring late. A fall of about 4 inches of S on the night of the 10th.

IRELAND.

CORK.—The month was mostly fine, but the winds were cold, and there were a few slight H showers. The spring is considered to be backward. Mean temp. 46°.

DROMORE.—Very little progress in vegetation until the last week of the month.

WATERFORD.—R ·62 in. below the average. Mean temp. 45°·4.

ROSS, O'BRIENSBRIDGE —Splendid weather until the 27th, but on the morning of the 28th the hills were white with S. Swallows late; cuckoo reported himself only on the 1st May.

DUBLIN.—The month was generally cold, cloudy, changeable and showery, with low pressure, and a preponderance of polar winds. Gale on 28th and 30th; S or sleet on 4th; H on 21st, 22nd, 23rd and 24th. Temp. below the average, having been lower in only three Aprils since the observations commenced in 1860. T on 30th.

OMAGH, EDENFEL.—With the exception of a short interval from 13th to 18th, the weather was cold, wet, and gloomy, and bore the character of October, rather than April. Sowing and farming operations generally were much retarded, but although there was no warmth, there was no frost, so that ordinary vegetation is not backward. The early summer migrants arrived about a week late.

TERRIBLE THUNDERSTORM AT BOULOGNE, MAY 6TH.

AN extraordinary thunderstorm visited Boulogne on Monday evening. It was not discovered until some time after the storm how disastrous had been its effects. The town presents an extraordinary appearance, the extent of the destruction being almost beyond description, fissures having been cut in the streets eight or ten feet deep, and so terrible was the force of the torrent that huge paving and curb stones, some of them weighing from two to four hundredweight, were torn up and hurled along by it for great distances. Openings were made sufficiently large to engulf a horse and cart; trees were in many cases torn up, and gardens washed away; while the basements in the lower part of the town were under water. The whole of the inhabitants were in a great state of terror, and it will take some time to restore the damage which has been caused. Subscriptions have been opened for the sufferers. Several persons had narrow escapes. One man was carried a considerable distance by the torrent and was much bruised. Two horses were killed by the lightning, and a man and woman were also struck.—*Daily News.*